Chillventa Specialist Forums 2024
Chillventa Fachforen 2024

CONNECTING EXPERTS.

Large Industrial Heat Pump installations with natural refrigerants benefitting semi-welded plate exchangers

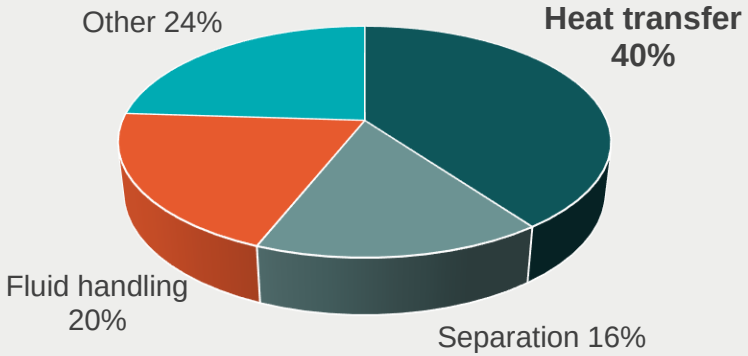
Tommy Angback, Alfa Laval

Eurammon e.V lecture event at Chillventa, 10 October 2024

eurammon
refrigerants delivered by mother nature

Alfa Laval group

Technologies



INVOICING 5,559	6,184 ORDER INTAKE	ROCE 21.0%	21,321 NO OF EMPLOYEES
16.1% ADJUSTED EBITA AS % OF SALES		893 ADJUSTED EBITA	

Energy

This area covers a wide range of industries such as Power, **HVAC&R**, Industrial process, – with a special focus on energy efficiency. environmental marine products.

Food & Water

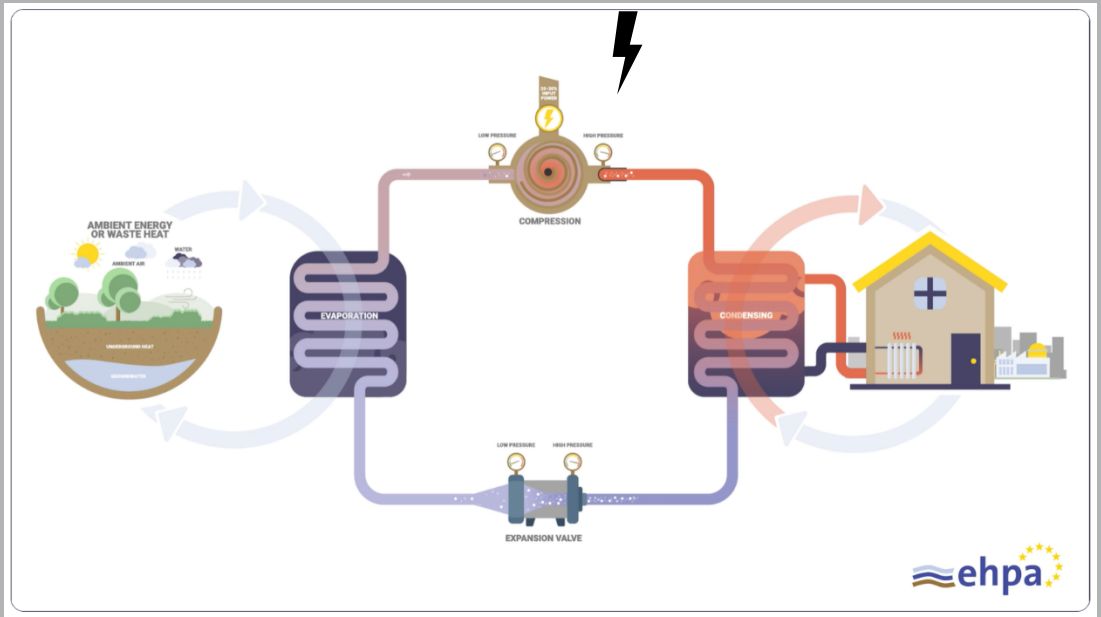
Offers products, solutions and systems in the areas of food processing and water treatment.

Marine

The company has supplied the marine industry since 1917 and has today a broad offering incl. environmental marine products.

Sustainable focus of Alfa Laval

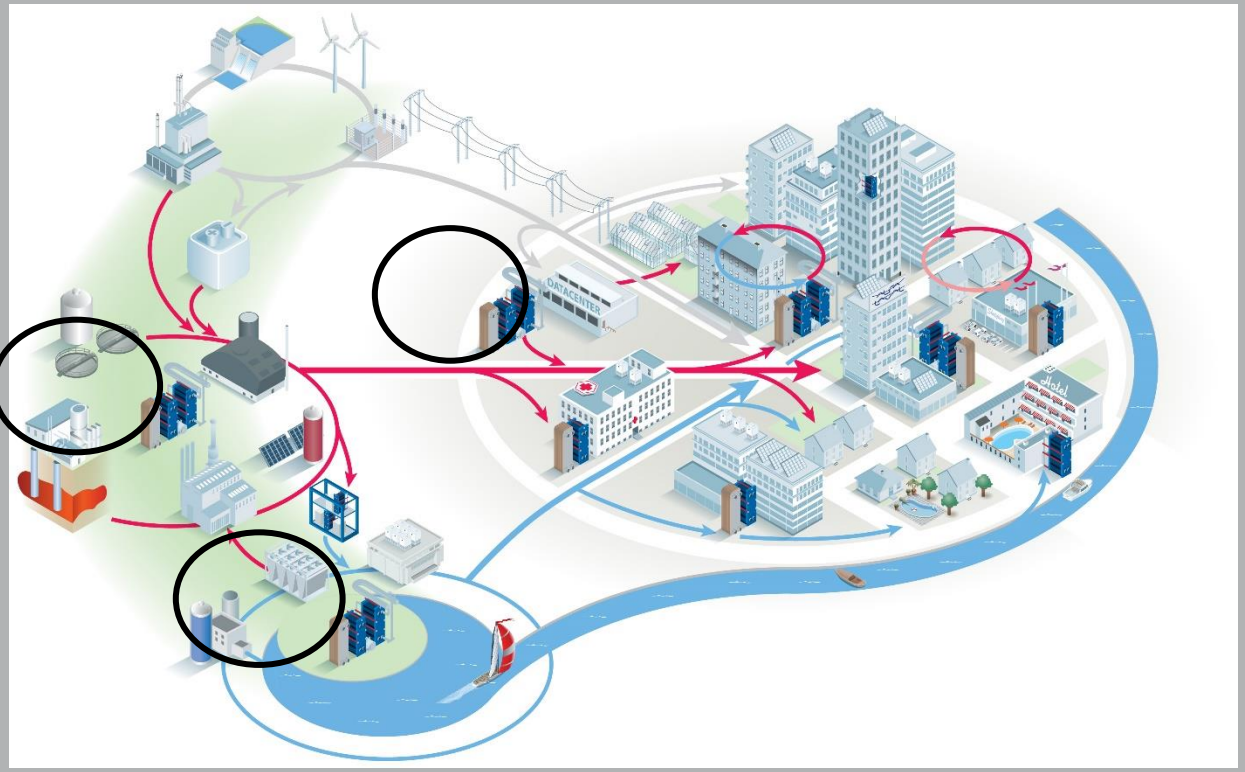
Heat pumps are key to reduce CO_2 emissions for heating



Heat pumps are widespread for residential but use now increasingly used for larger capacities.

High efficiency (COP) of the heat pumps is crucial to limit the electrical consumption and reduce running cost.

Large heat pump opportunities in a sustainable city



Sustainable supply

Not only a supply of affordable heat exchangers. Our partnership offers solutions

Designed for **efficiency supporting high COP**

Designed for **safe use with natural refrigerants**

Designed for **compactness**

Assuring **long operational lifetime**

Reducing **carbon footprint** of components

Customer cases

Alfa Laval has for the last 10 years delivered heat exchanger components to many hundreds of medium and large industrial heat pump installations.

In cooperation with the heat pump system supplier.

We will briefly describe a couple of the larger ammonia heat pump installations in operation.

Sewage water heat recovery

Customer case: Odense, Denmark
Sewage water heat recovery in operation since 2020

The installation of heat pumps at wastewater treatment plants has untapped potential to harness energy from treated sewage, providing greener, cheaper heating for district heating systems.

Since 2020, treated wastewater in Odense has been routed through a heat pump system instead of directly into the river.
Apart delivering heat this setup reduces the discharge temperature to match the river's, benefiting the aquatic environment while cutting 128 000 tonnes of CO_2 emissions over 5 years.

Sewage water heat recovery

Heat pump data

Annual district heating production	~80,000 MWh/year
Heating capacity	20 MW
1 x four-step heat pump	20 MW
COP heating	4.0
Refrigerant	R717 Ammonia

Source side

Sewage water available design temperature	11°C
Intermediate glycol loop supply temperature	9°C

Sink side

Heating water total	40°C → 65°C

First stage		
Heating water	40°C → 46°C	Tcond 49°C
Cooling glycol	5°C → 4°C	Tevap 0.5°C
Second stage		
Heating water	46°C → 53°C	Tcond 55°C
Cooling glycol	6°C → 5°C	Tevap 2°C
Third stage		
Heating water	53°C → 59°C	Tcond 61°C
Cooling glycol	7°C → 6°C	Tevap 3°C
Fourth stage		
Heating water	59°C → 64°C	Tcond 66°C
Cooling glycol	9°C → 7°C	Tevap 4°C
Oil cooling		
Heating water	64°C → 65°C	

Sewage water heat recovery

Main heat pump components

Alfa Laval supply of semi-welded plate heat exchangers

4 pcs	flooded evaporators	T20BW-FD
4 pcs	condensers	TK20BW-FX
8 pcs	sub coolers and oil coolers	M10BW/T10EW in addition

Other main component supply

- 4 pcs Mayekawa screw ammonia compressor 280J
- Elin water cooled motors
- Atlas flooded separator
- Grundfos circulation pumps (glycol and water)

Greenhouse heating

Customer case: Fenland, UK

Heat recovery from irrigation water ponds

Finished in 2022 AGR Renewables Ltd developed the 20 Ha sustainable greenhouse complex powered through a combination of industrial heat pumps and CHP (Combined Heat & Power) gas engines.

The heat pumps from IES Energy Aps are recovering heat from the irrigation water collected in large ponds. The heat pump installation consists of four ammonia heat pumps installed in parallel, total capacity of 33 MW delivering 65 000 MWh of thermal heating and reducing 12,600 tonnes of CO_2eq emissions annually.

This installation providing the hot water for heating of the glasshouse qualified for the UK Renewable Heat Incentive (RHI) scheme.

Greenhouse heating

Heat pump data

Annual heating production (heat pump)		~65,000 MWh/year
Heating capacity		33 MW
1 x single-step heat pump	4.7 MW	COP 4.3
3 x two-step heat pumps	9.4 MW	COP 4.5
Refrigerant		Ammonia totally 2600 kg

Source side, single step

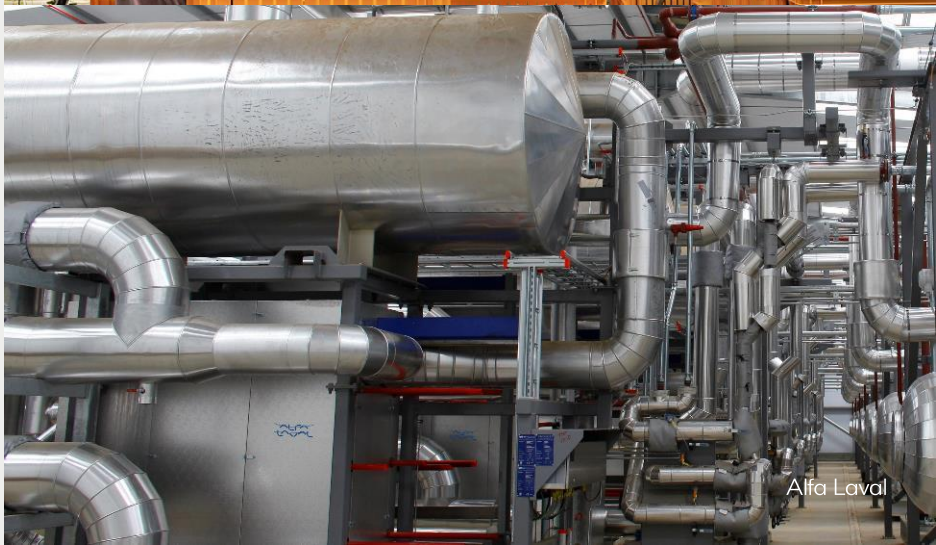
Irrigation water	12°C → 8°C
Intermediate glycol loop	10°C → 6°C
Evaporation temperature	3.5°C

Sink side, single step

Heating water total	35°C → 55°C
Condenser heating water	35°C → 52°C
Condensing temperature	53°C
Compressor oil cooling heating water	52°C → 55°C

Intermediate temperature steps in the two step heat pumps not available

Heat exchanger technology for heat pumps



Greenhouse heating

Main heat pump components

Alfa Laval supply of semi-welded plate heat exchangers

7 pcs flooded evaporators	T20BW-FD
7 pcs condensers	T20BW-FT
7 pcs sub coolers	M10BW/T10EW in addition

Other main component supply

4 pcs Mayekawa screw ammonia compressor 280J
Elin water cooled motors
Atlas flooded separator
Grundfos circulation pumps (glycol and water)

Data center heat recovery

Customer case: Fyn, Denmark

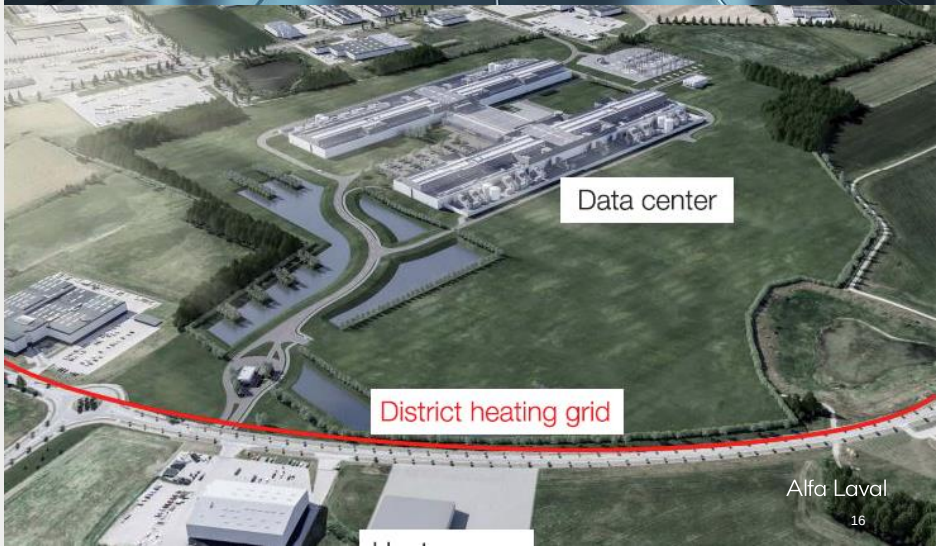
Leading social media giant is minimizing the energy, emissions, and water impact, beyond their operations

Sector coupling was made possible by a partnership with the local district heating company who were looking for new heat sources to phase out fossil fuels.

The district heating company made the additional heat pump investment to recover the waste heat. The data center proximity to the local heat distribution grid did minimize additional infrastructure connecting the heat pumps to the district heating network.

This heat recovery infrastructure will help recover 100,000 MWh of energy per year – enough to warm some 7,000 homes and reduce CO_2 emissions for heating those by 90%.

IES Energy A/S delivered one highly efficient industrial heat pump designed in cooperation with leading main component suppliers such as Mayekawa (compressors) and Alfa Laval (plate heat exchangers).



Data center heat recovery

Heat pump data

Annual district heating production		~80,000 MWh/year
Heating capacity		20 MW
1 x three-step heat pump		20 MW
Refrigerant		R717 Ammonia
COP heating		4.7
COP cooling		3.7
Source side		
Cooling water from data center		27°C → 15°C
Sink side		
Heating district heating water		40°C → 75°C
First stage heat pump		
Heating water	40°C → 52°C	Tcond 57°C
Cooling water	19°C → 15°C	Tevap 12°C
Second stage heat pump		
Heating water	52°C → 63°C	Tcond 67°C
Cooling water	23°C → 19°C	Tevap 16°C
Third stage heat pump		
Heating water	63°C → 75°C	Tcond 77°C
Cooling water	27°C → 23°C	Tevap 20°C

Data center heat recovery

Main heat pump components

Alfa Laval supply of semi-welded plate heat exchangers

3 pcs	flooded evaporators	T20BW-FD
3 pcs	condensers	TK20BW-FX
6 pcs	sub coolers and oil coolers	M10BW/T10EW in addition

Other main component supply

- 3 pcs Mayekawa screw ammonia compressor 280J
- 2 pcs Mayekawa reciprocating compressor HS6
- Elin water cooled motors
- Atlas flooded separator
- Grundfos water circulation pumps

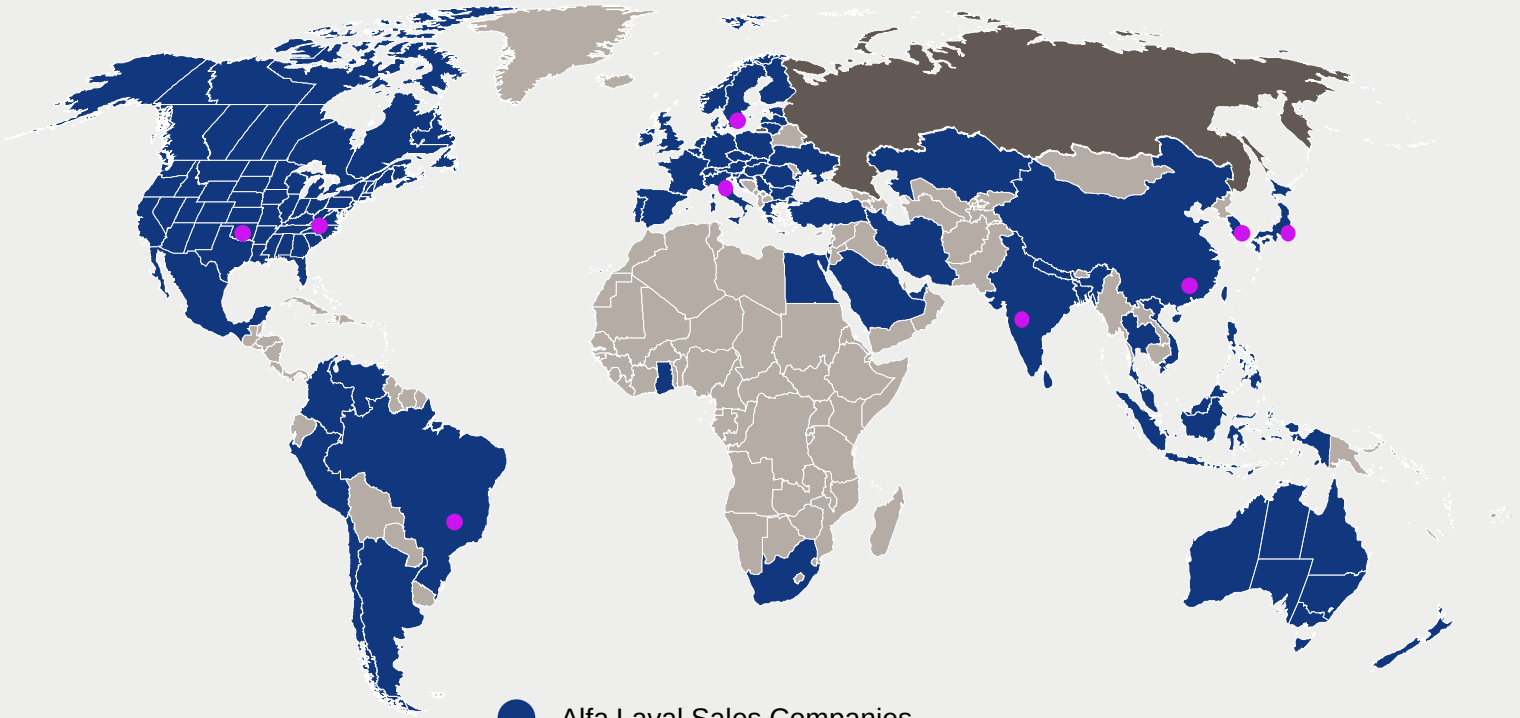
Thermal storage in addition

- Sink side district heating water (several)
- Source side from data center 5,000 m³

What can we offer?

- Technology leadership in heat transfer
- Sustainable solutions
- Global and scalable supply
- Large installed base and proven success
- Sustainable performance throughout the life-cycle with complete service offering
- Partnerships

Your worldwide partner



Alfa Laval Sales Companies

Alfa Laval main Manufacturing Sites:
Heat Transfer products

Come visit
Alfa Laval
Hall 6 Booth 138

We showcase

- **T21-BWcFX – The largest compact Ammonia Heat pump condenser**
- Capacity up to 20 MW
- Reinforced Alloy 316 cassettes with 63 Bar (PED) frame approval

- **SE43 – Evaporator and condenser for chillers and heat pumps with propane**
- Asymmetric channels for efficiency and low pressure drop
- Reduced refrigerant charge

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Hall 7A

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